School of Engineering

CHEE2935: Resource and Energy Optimisation

International Summer Compressed Course (DRAFT*)

June-July 2023

*This is an unofficial Course Outline and while the delivery structure may be amended to accommodate the International Summer Compressed Course, the content delivered herein will not differ from the content delivered within a normal Semester. The final document will be approved and provided to students by 5 June 2023.

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

COURSE OUTLINE

OVERVIEW

Course Description

This course introduces you to the concepts of sustainability and cleaner production as applied in an industrial context. The course explores the potential role of engineers in the development of sustainable technologies, with a focus on energy and resources. Process impacts including atmospheric pollution and water use are also considered in addition to greenhouse gas emissions from a variety of energy technology types. Quantitative tools to optimise chemical processes are outlined to increase resource use efficiency.

Requisites

This course replaces CHEE2931. If you have successfully completed CHEE2931 you cannot enrol in this course.

Assumed Knowledge

MATH1110 Mathematics for Engineering, Science and Technology 1, and MATH1120 Mathematics for Engineering, Science and Technology 2, or equivalent.
CHEM1010 Introduction to Chemistry I, and CHEM1020 Introduction to Chemistry II, or equivalent.

Contact Hours

Lecture
Online and/or Face to Face on Campus
6 hour(s) per Week for Full Term (Four Weeks)

Tutorial
Online and/or Face to Face
6 hour(s) per Week for Full Term (Four Weeks)

Unit Weighting

10

Workload

Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator
To be confirmed
Consultation: By appointment

Teaching Staff
Other teaching staff will be advised on the course Canvas site.

School Office
School of Engineering
ES408
ES Building
Callaghan
+61 2 4921 5798
9am-1pm, and 2pm-5pm (Mon-Fri)

SYLLABUS

Course Content
Topics to be covered in this course include:

- State of the world, role of engineers and sustainable engineering principles.
- Life cycle analysis (concepts and application).
- Analysis of fossil fuel and renewable energy technology impacts.
- Pinch technology and Heat Exchanger Network (HEN) analysis.
- Evaluating and comparing energy technologies for sustainability.
- Sustainable hydrogen production use.
- Case Study.

Course Learning Outcomes
On successful completion of this course, students will be able to:

1. Demonstrate a thorough understanding of the concepts of sustainability and cleaner production, and the challengers that engineers face in applying these concepts in an industrial and societal context.
2. Show familiarity with the concept of cleaner production and how to apply it to real life applications.
3. Exhibit an understanding of basic principles of green engineering applied to product design and manufacturing processes.
4. Quantify environment flows using appropriate mass and energy analysis.
5. Assess different energy sources in their ability to deliver clean and reliable electricity and heating/cooling utilities.
6. Optimise optimal heat exchanger systems in order to reduce overall energy consumption.
7. Critically analyse environmental emissions and develop simple methodologies to reduce these emissions.
8. Present clear arguments to support findings of analysis undertaken as part of an open-ended Case Study.

SCHEDULE

Week	Week Begins	Topic	Learning Activity	Assessment Due
1	12 June	• Teaching Block 1*	• Online and face-to-face activities.	Quiz #1 (15% of final mark)
2	19 June	• Teaching Block 2*	• Online and face-to-face activities • Field trip** – Newcastle Institute for Energy and Resources (and associated Centres – Frontier Energy Technologies and Utilisation; Centre for Advanced Energy Integration), University of Newcastle https://www.newcastle.edu.au/research/centre/nier	Quiz #2 (15% of final mark)
3	26 June	• Teaching Block 3*	• Online and face-to-face activities • Field trip** – CSIRO Energy Centre Newcastle https://www.csiro.au/en/about/locations/state-locations/NSW/Newcastle	Quiz #3 (15% of final mark)
4	03 July	• Teaching Block 4*	• Online and face-to-face activities	Case Study due (20% of final mark) Final Exam (35% of final mark)

**See Syllabus/Course Content on Page 2. Specific sequence of topics will be confirmed by 5 June 2023.*
***To be confirmed*

ASSESSMENTS

This course has 3 assessment types. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting*	Learning Outcomes
1	Quiz #1, #2, #3	Weekly	Individual	45%	1, 2, 3, 4
2	Case Study	Week 4	Individual	20%	1, 2, 3, 4, 5, 7, 8
3	Final Examination	Week 4	Individual	35%	1, 2, 3, 4, 5, 6

**Weighting may be amended. Will be confirmed by 5 June 2023*.

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 – Quiz #1, 2, 3

Assessment Type Quiz
Description Series of 3 multiple choice quizzes based on course lecture material.
Weighting 45% (3 x 15%)
Due Date End of Weeks 1, 2, 3.
Submission Method In Class or Online
Assessment Criteria
Return Method In Person or Online.
Feedback Provided Returned Work or Online.

Assessment 2 – Case Study

Assessment Type Written Assignment
Purpose The Case Study considers the delivery of an efficient and environmentally friendly solution for a localised community with specific needs. Looks at simple treatment technologies to minimise energy consumption and how renewable energy sources can be implemented/integrated on site. Life cycle analysis is an option that might also me considered.

Weighting	20%
Due Date	Week 4.
Submission Method	Online Submission via Turnitin link found in the Assessments tab of the Canvas page
Assessment Criteria	See marking rubric in the Assessments tab of the Canvas page.
Return Method	Online
Feedback Provided	Online - Rubric scores and online comments

Assessment 3 – Final Examination

Assessment Type	Formal Examination
Description	Includes ALL material delivered in the course. Questions are a combination of multiple choice, calculations, and essay-style answer.
Weighting	35%
Due Date	End Week 4
Submission Method	In Class or Online
Return Method	Not returned
Feedback Provided	-

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Attendance

Attendance/participation will be recorded in the following components:

- Face-to-Face Lecture/Tutorial (Method of recording: Class list)
- Field trips (Method of recording: Class list)

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.
- Email: Students will receive communications via their student email account.
- Face to Face: Communication will be provided via face to face meetings or supervision.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination Guidelines. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:

https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The 'HELP for Students' tab in UoNline contains important information that all students should be familiar with, including various systems, policies and procedures.

This course outline was approved by the Head of School. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified, and an amended course outline will be provided in the same manner as the original.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on the 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements / Engineers Australia Stage 1 Competency Standards	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability	✓	✓	✓	2
12	3.2. Effective oral and written communication in professional and lay domains		✓	✓	2
13	3.3. Creative, innovative, and pro-active demeanour				
14	3.4. Professional use and management of information				
15	3.5. Orderly management of self, and professional conduct				
16	3.6. Effective team membership and team leadership				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving	✓	✓	✓	2
8	2.2. Fluent application of engineering techniques	✓	✓	✓	2
9	2.3. Application of systematic engineering synthesis and design processes	✓	✓	✓	2
10	2.4. Application of systematic approaches to the conduct and management of engineering projects				
	Knowledge Base				
1	1.1. Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals to the engineering discipline	✓	✓	✓	2
2	1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓	✓	✓	2
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓	✓	✓	2
4	1.4. Discernment of knowledge development and research directions within the engineering discipline	✓			2
5	1.5. Knowledge of contextual factors impacting the engineering discipline	✓			2
6	1.6. Understanding the scope, principles, norms, accountabilities, and bounds of contemporary engineering practice in the engineering discipline	✓			2